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Foreword

Although still embryonic in its development, criminal justice research could evolve like the fields of health and engineering, where research and practice have successfully converged on solutions to mutual problems and where each looks to the other for information and guidance. The National Institute of Justice looks forward to acting as a broker in this most important process.

Forensic sciences give us a notable example of how the justice system weds the recondite and the practical: the laboratory is dependent on the policeman and detective; the prosecutor is often dependent on the laboratory.

The Institute's forensic research aims toward the twin goals of developing new tools and techniques, and ensuring that wider knowledge of forensic science capabilities leads to their optimum practical use. This booklet tells some of our progress thus far toward these goals.

James K. Stewart
Director
National Institute of Justice

Introduction

As the number of rape victims grew, investigators suspected a single assailant was to blame. Specimens taken in examinations of six of the victims soon after they were attacked were sent to the Oakland, Calif., Police Crime Laboratory. Based on genetic markers found both in human semen and human blood, the crime lab constructed a biological profile of the rapist.

The profile showed genetic characteristics existing in only 2 percent of the population. Several suspects already in custody submitted to blood typing and, when their blood failed to reveal the telltale markers, were eliminated from the case. Then a blood sample was taken from an injured burglary suspect who was receiving first aid. Analysis of the blood revealed the unique markings of the biological profile. A court accepted the genetic match as probable cause and issued a warrant to search the suspect's dwelling.

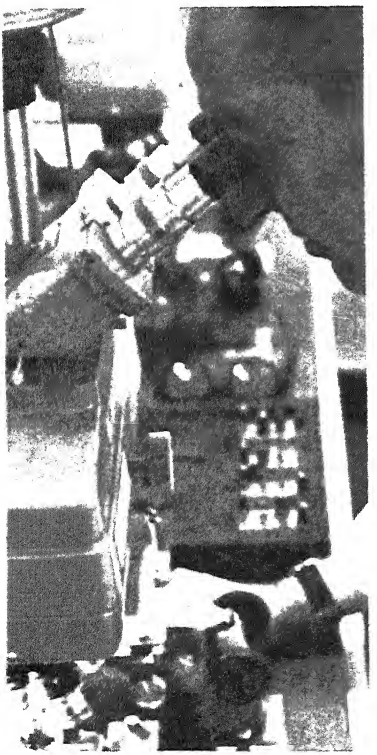
When shoes and other clothing belonging to the rape victims were found there, forensic science had proven a new method to help solve crimes.

evidence: something that furnishes proof. In a criminal trial, the means of satisfying the triers of fact, such as a jury, of the truth or falsity of allegations.

Television's Quincy would have been proud. So would the late author Lawrence G. Blochman's white-coated detective, Daniel Webster Coffey, M.D. Increasingly, real-life achievements in forensic science—many of them products of National Institute of Justice research—are challenging the forensic feats of fiction.

In perhaps no field have these breakthroughs been so recent and dramatic as in forensic serology—the study of blood and other body fluids ("serums") as applied to the process of law. This booklet concerns not only serology—highlighted in the next chapter—but also other branches of forensic science, defined as the study and application of science to the examination, evaluation, and explanation of physical evidence in law. Fingerprints, blood, hair, fibers, weapons, drugs, and toolmarks are but a few examples of physical evidence. Such are the things with which forensic scientists concern themselves.

Drs. Quincy and Coffey are pathologists. Forensic science, however, encompasses a number of other disciplines as well, including criminalistics, toxicology, physical anthropology, odontology (dental structure, development, and diseases), psychiatry, questioned documents, jurisprudence—and, of course, serology.



A number of Government commissions, Supreme Court decisions, practitioners, and researchers have advocated greater reliance on physical evidence, suggesting that its proper utilization enhances police investigations, conviction rates, and citizen satisfaction with the criminal justice system. Justice Goldberg's majority decision in *Escobedo* (1964) said:

> *We have learned the lesson of history, ancient and modern, that a system of criminal law enforcement which comes to depend on the "confession" will, in the long run, be less reliable than a system which depends on extrinsic evidence independently secured through skillful investigation.*[1]

[1] Quoted in Task Force Report: *Police*, The President's Commission, 1967. See also Task Force Reports: *Science and Technology* and *Police*, National Commission on Criminal Justice Standards and Goals, 1973. Publication and availability information on all documents cited appear in the Selected Readings (list begins on page 23).

Among the goals of the National Institute of Justice (NIJ) is sponsorship of research that will contribute to forensic science performance and its greater use by the criminal justice system.

This booklet presents highlights of the National Institute's forensic research so that law enforcement practitioners and local policymakers can learn more about the use of crime laboratories and physical evidence in criminal cases. The booklet also includes information on how to obtain the research documents briefly mentioned here. Lists of newsletters, journals, and forensic agencies and organizations are also included to direct the reader to other resources.

physical evidence: *tangible material from the scene of a crime, or from the person of a victim or perpetrator, that objectively relates to the understanding or proof of a crime. Also called* **real** *evidence.*

Tiny drops of evidence

Blood typing has been with us roughly since the turn of the century, about the same time we learned that fingerprints offered a positive form of identification. Only in the last 10 years, however, has the forensic serologist begun to believe that the genetic markers in blood and other body fluids may someday prove as definitive as fingerprints.

Working from the standard ABO blood typing, certain forms of negative evidence have long been available. Added sophistication came with the discovery of additional subgroups of genetic markers in blood—invaluable, for example, in even the simplest transplant surgery—and with the discovery in the 1920's that genetic markers are present not only in blood but in other body fluids—perspiration, urine, semen, saliva, and vaginal fluids.

These were of little forensic use, however, despite their life-saving clinical efficacy, because of the different circumstances under which the clinical scientist and the forensic serologist must work.

Rather than a plentiful sample of whole blood freshly drawn from a patient, the crime laboratory is likely to receive a tiny fleck of dried blood or other fluid—perhaps on a shirt or a scrap of rag, of unknown age, from an unknown "donor," and often having spent hours in a car trunk or stuffed into a closet, exposed to air, high temperature, and other contaminants.

British scientists found a method for identifying markers more precisely in small laboratory samples. Dr. Brian Culliford of Scotland Yard pioneered use of a process called electrophoresis, in which the sample is placed on a tray containing a gel and an electrical current is passed through the equipment. An analyst can then read the resulting patterns to determine the presence of various proteins and other markers.

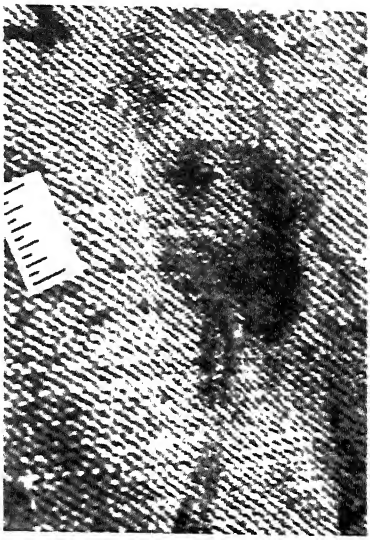
The analysis made it possible to identify several thousand subgroups rather than the 12 known before and, in 1970, the National Institute of Justice sponsored a workshop for some 20 representatives of major crime laboratories to introduce the use of this technology. The workshop manual, *Examination and Typing of Bloodstains in the Crime Laboratory*, led to widespread American use of electrophoresis.

Nevertheless, the equipment and personnel for these techniques were expensive, and the process could lead to the destruction of scarce evidentiary material. When a blood-flecked shirt had to be preserved for trial, the repeated tests—one for each marker—led to increasing deterioration of the evidence and the cost of a week or more of laboratory time for the sequence of tests.

The National Institute then sponsored research to determine the feasibility of performing multiple electrophoretic analyses simultaneously. Another British researcher, Brian Wrexall, demonstrated that simultaneous analyses, using inexpensive off-the-shelf equipment, could test for 10 different genetic markers within a 24-hour period.

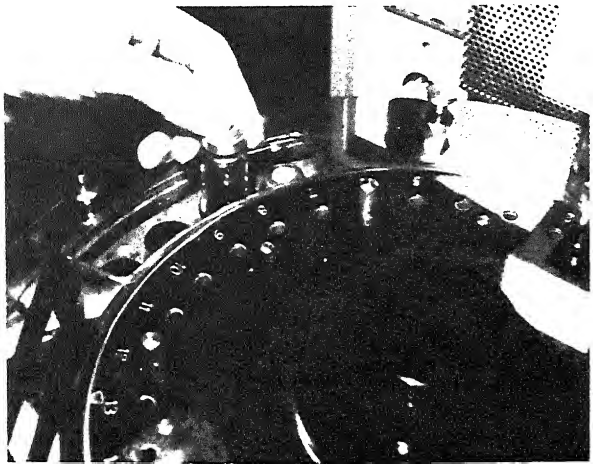
The National Institute successfully field-tested the procedure in 1977 in four major crime laboratories and sponsored training of 92 additional forensic scientists. Meantime, further research enlarged the number of simultaneously identifiable markers.

(Other blood studies for the National Institute were enlarging the crime lab's arsenal at the same time. A 1971 study applied ballistic principles to bloodstain patterns at crime scenes to help reconstruct conditions at the moment of bloodshed; the published report is called *Flight Characteristics and Stain Patterns of Human Blood*. A 1972 study established ultraviolet spectography as the most promising method of determining the age of bloodstains; findings were published as *Determination of the Age of Bloodstains by Nondestructive Methods*.)



". . . a tiny fleck of dried blood or other fluid—perhaps on a shirt or a scrap of rag, of unknown age, from an unknown 'donor' . . ."

". . . an analyst can read the resulting patterns . . ."

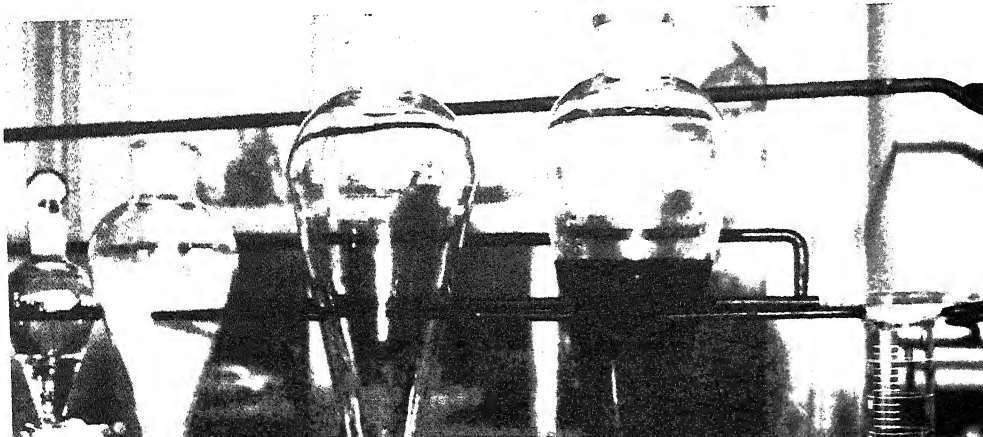


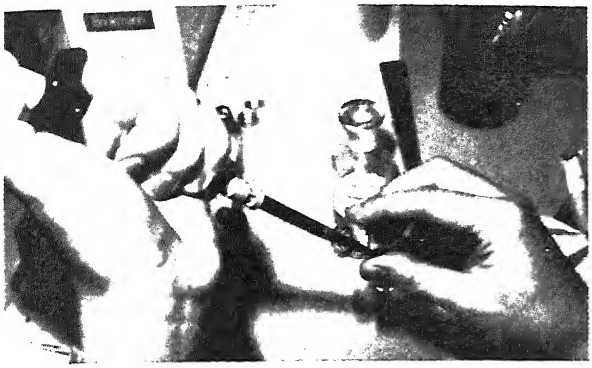
Robert Shaler, Ph.D., a serologist with the New York City medical examiner's staff who had participated earlier in National Institute research, identified and quantified markers unique to either Caucasians or blacks, and developed techniques to determine sex and the use of certain drugs. Shaler's work with assay techniques for old bloodstains showed that markers showing sex and race can be detected in samples as old as 45 days.

While the research on individualization of bloodstains continues, forensic serologists have become increasingly concerned with the quality of antisera—the reagent compounds used in identifying the blood type and other blood variants in dried blood. The prevailing view has been that the quality of these commercially available reagents is generally poor. Through another Institute-funded research project, Dr. R.E. Gaensslen of the University of New Haven has developed a manual of procedures and evaluations of antisera for the typing of certain blood and serum group antigens in bloodstains. The report was published as *Procedures and Evaluation of Antisera for the Typing of ABH, Rh, MNSs, Kell, Duffy, and Kidd Blood Group Antigens and Gm/Km Serum Group Antigens in Bloodstains.*

As bloodstain analysis techniques progressed, so did the genetic typing of semen and other body fluids. Forensic analysis now can not only determine with greater certainty whether a rape has occurred, but can also help corroborate a victim's identification of the assailant. Among leaders in this research were Dr. George Sensabaugh of the University of California at Berkeley, Dr. E.T. Blake, and Ms. Jan Bashinski, director of the Oakland, Calif., Police Crime Laboratory.

". . . simultaneous analyses could be carried out, using inexpensive off-the-shelf equipment . . ."





"As bloodstain analysis techniques progressed, so has the genetic typing of semen and other body fluids"

Their research was published as *Identification and Individualization of Semen in the Investigation of Rape*. Now the Sensabaugh team is testing a method for making their techniques available through any standard laboratory.

Ms. Bashinski, whose use of genetic markers to spot a multiple-rape suspect was recounted at the beginning of this booklet, has helped discover ways to stop deterioration of samples. Dr. Blake hopes to identify and quantify a series of additional genetic markers, thus further "individualizing" each sample.

With present techniques, the chance that two persons are exactly matched in the most common combinations of bloodstain markers is 1 in 200. With rarer combinations, the odds lengthen to 1 in 100 million. The odds will have to get far longer—1 in 200 million—before serological identification is considered as reliable as fingerprints. Already, however, laboratory findings can sharply narrow the field of suspects, decreasing the possibility that a defendant may be wrongly accused.

To provide a comprehensive reference tool for laboratory workers, the National Institute of Justice funded a project to develop a manual, which was published as *Sourcebook of Forensic Serology, Immunology, and Biochemistry* by Robert E. Gaensslen, Ph.D. It is newly available through the National Institute of Justice/NCJRS and the U.S. Government Printing Office. See the Selected Readings that begin on page 23 of this booklet.

Note—Much of the preceding narrative was derived from an article by Mary Gibbons Graham and Joseph Kochanski, both of the National In-

Fine-tuning laboratory techniques

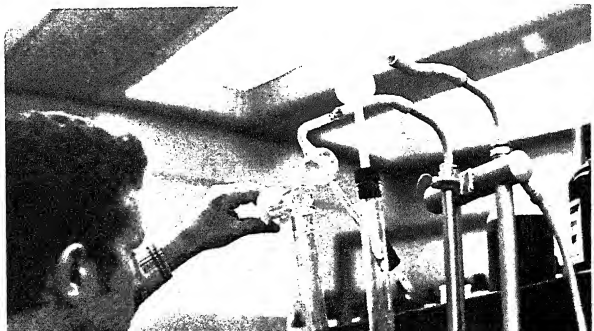
In 1966, there were approximately 110 crime laboratories in the United States. According to the American Society of Crime Laboratory Directors, this number had grown to approximately 250 in 1983.

The National Institute of Justice initiated a nationwide program in 1974 to test the proficiency of crime laboratories. Physical evidence samples that were manufactured and mailed to more than 200 laboratories around the country included controlled substances, blood, paint, glass, hair, fiber, firearms, physiological fluids, questioned documents, wood, arson accelerants, soils, and metals. The study revealed that proficiency testing is both feasible and necessary, but it found many laboratories lacked adequate financial resources for a continuing program. Recommendations resulting from these findings included:

- Continuous proficiency testing of crime laboratories by a peer group.

"Physical evidence samples were manufactured and mailed to more than 200 laboratories . . ."

". . . controlled substances, blood, paint, glass, hair, fiber, firearms, questioned documents, wood, arson



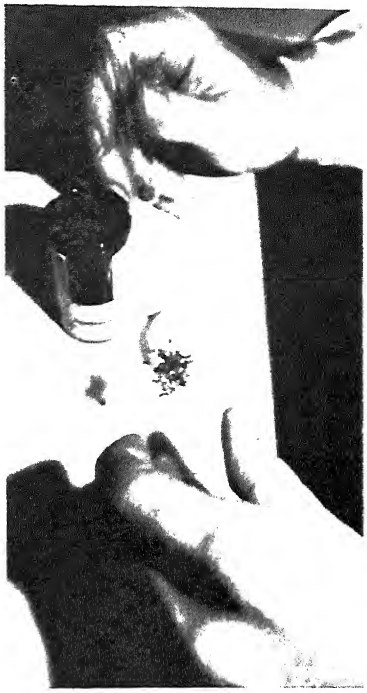
- Future proficiency testing programs that included technical assistance.
- Regional workshops to address education and training needs.
- Funding to correct deficiencies in physical and human resources resulting from inadequate laboratory budgets.

Findings and recommendations were published as *Crime Laboratory Proficiency Testing Research Program* (see reading list). In 1980, the Institute funded a similar nationwide assessment of the proficiency of analytical toxicologists to detect, identify, and quantify drugs, their metabolic products, and chemicals in biological specimens for medicolegal purposes. The study showed that laboratories are willing to participate in such proficiency testing programs—the response rate was more than 60 percent—and that satisfactory analytic results were obtained.

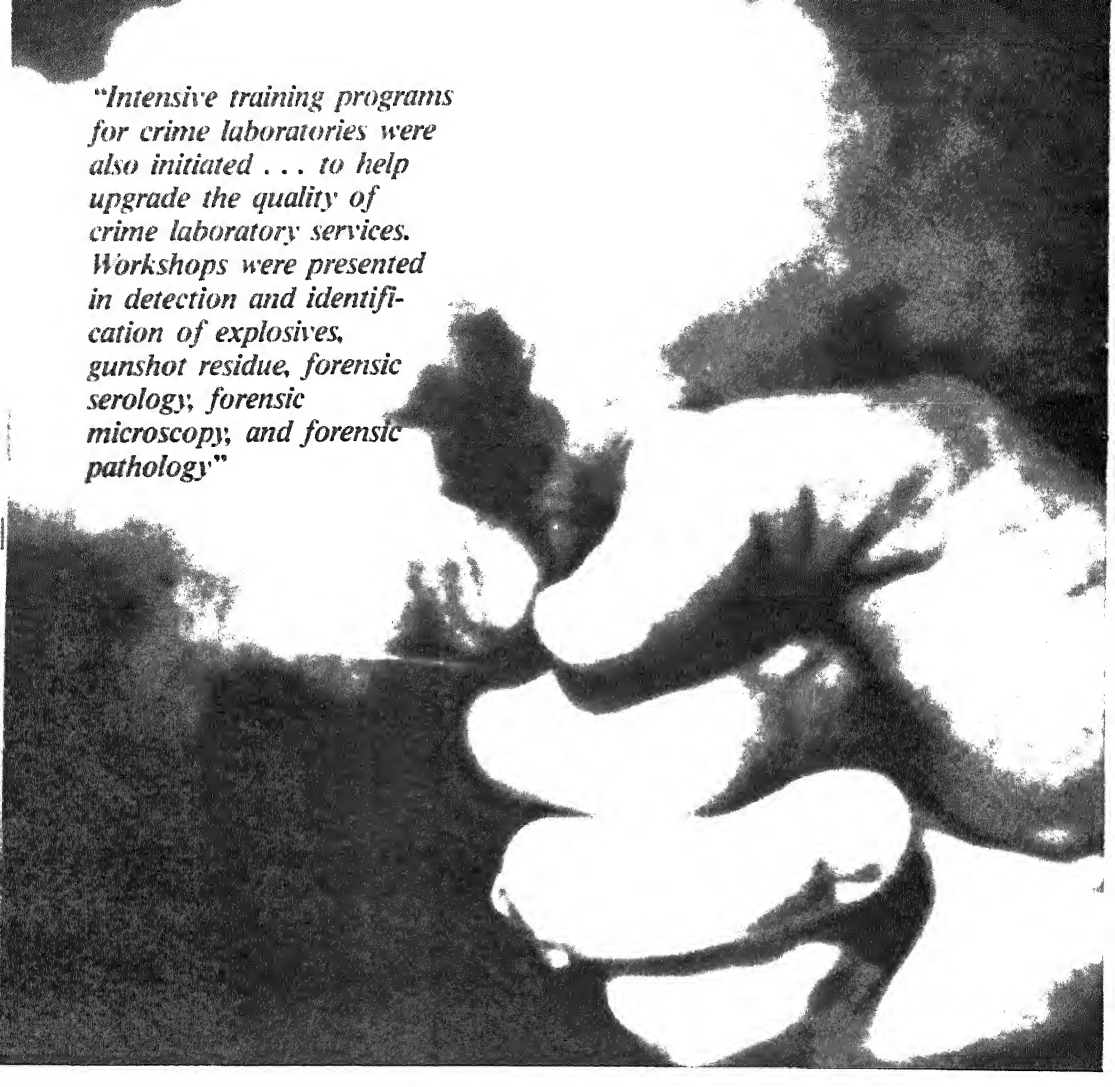
The researchers recommended that a continuing proficiency testing program should run for not less than 3 years and should include samples replicating typical case samples and a coding system to protect the anonymity of participating laboratories. Further recommendations included a nationwide education program in toxicology, evaluation of modern analytic techniques, and a program to make metabolic products of parent drugs available to practicing toxicologists. The final report is called *Forensic Toxicology Laboratory Proficiency Testing Research Program*.

Intensive training programs for crime laboratories were also initiated by the Institute to help upgrade the quality of crime laboratory services. Workshops were presented in detection and identification of explosives, gunshot residue, forensic serology, forensic microscopy, and forensic pathology. Several reports resulted from these training workshops:

- *New Concepts Symposium and Workshop in Detection and Identification of Explosives—Proceedings.*
- *Forensic Microscopy Workshop.*
- *A Summary of the State-of-the-Art of Forensic Microscopy.*
- *Forensic Pathology: A Handbook for Pathologists.*



". . . a nationwide assessment of the current proficiency of forensic analytical toxicologists . . ."



"Intensive training programs for crime laboratories were also initiated . . . to help upgrade the quality of crime laboratory services. Workshops were presented in detection and identification of explosives, gunshot residue, forensic serology, forensic microscopy, and forensic pathology"

The National Institute also conducted research on various types of physical evidence to assist in upgrading crime laboratory services. Much of the knowledge gained from this research has been used in Institute-sponsored training workshops and in crime laboratories around the country.

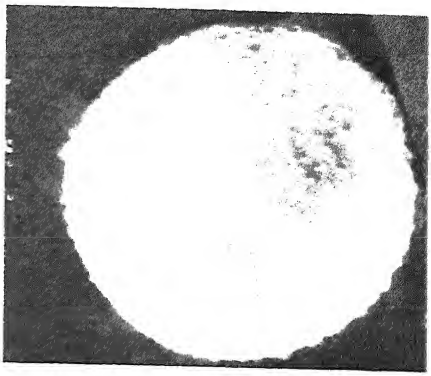
Sometimes an investigative technique has been developed to the point where its use yields findings that point to a conclusion but still lack the positive certainty required for courtroom use. In these cases, research may turn toward developing the existing art into a science.

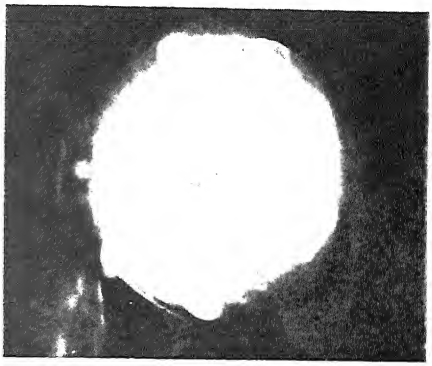
A 1972 research project presented an initial attempt to develop a technique that would allow investigative officers to tell whether or not a firearm had recently been fired in a room and, if so, the time of the firing. Neutron activation analysis was the basic approach detailed in the final report, *Development of Techniques for the Detection of Airborne Gunshot Residues.*

New characteristics for laboratories to test in determining if a firearm has been discharged, and how recently, were explored in a feasibility study titled *Time-Dependent Electron Spin Resonance Characteristics of Gunpowder and Primer Residue.*

Determination of whether a person has recently fired a gun was finally achieved, to the point of court admissibility, by researchers of the Aerospace Corp. in a study called *Particle Analysis for the Detection of Gunshot Residue.* The system relies on a scanning electron microscope to positively identify gunshot residue on the hands or clothing of the shooter.

An average individual will lose 30 to 50 hairs in a given day. In violent activity, hair loss is even higher and, in cases of physical assault or rape, there is invariably an exchange of hair and other fibers between attacker and victim. A 1974 study developed biochemical techniques to characterize hair proteins so as to identify specific hair samples. The report is called *Variant Polypeptides in Hair.*





". . . to positively identify gunshot residue on the hands or clothing . . ."

". . . identify synthetic fibers obtained as trace evidence at crime scenes"

The same research team showed that enough blood usually clings to the root bulb of a lost hair that it can be treated like a bloodstain and used to narrow identification through electrophoresis.

Another project collected and organized analytical data to enable crime laboratories to measure very small synthetic fibers from crime scenes. Additional microchemical tests are being conducted to identify specific substances. The results of this study, *Microscopic Identification of Synthetic Fibers*, will provide crime laboratories with the necessary data for characterizing small fiber segments through single microscopic and microchemical tests.

Ongoing research on speech patterns involves voice identification using advanced computer techniques. It seeks to put on a more scientific basis the findings of early-1970's research on patterns derived from the human speech signal—the "voiceprint." The current study is called *Semi-Automatic System for Speaker Identification*.

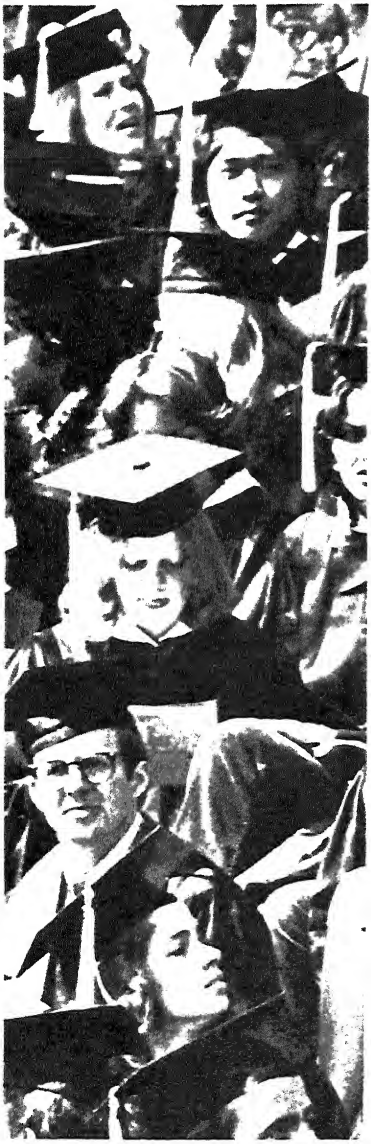
With the assistance of the Law Enforcement Standards Laboratory, which it sponsors, the National Institute conducted a state-of-the-art review of forensic science reference materials. The study identified 34 types of reference materials being used or having potential use in a reference collection. The report is titled *Standard Reference Collection of Forensic Science Materials: Status Needs*.

A number of standard reference materials have been produced and made available to laboratories, covering auto paints and glass, fibers, hairs, etc.

Recognizing the inadequacies of death investigations in the United States, the Institute funded a project in 1980 to develop minimum voluntary standards for the medicolegal investigation of deaths. This project drew from a multidisciplinary panel of medical examiners, coroners, forensic toxicologists, criminalists, forensic anthropologists, and forensic odontologists. The final product of this effort is a manual entitled *Death Investigation and Examination: Medicolegal Guidelines/ Checklists*. The manual, organized to reflect the general order in which an average death investigation is accomplished, presents a comprehensive set of guidelines and checklists for the investigation of death.

". . . characterizing small fiber segments by means of single microscopic and microchemical tests"

Science and technology—management and personnel development



Courtesy of Black Star, 1978

Increased demand for forensic science services brought with it a tremendous increase in the number of personnel in the field. In 1969, the American Academy of Forensic Sciences had 80 members; by 1982, it had 2,323. Concerned with the effects of the increased demand on quality of services, the National Institute began to explore the need for improved education and training and more efficient delivery of laboratory services.

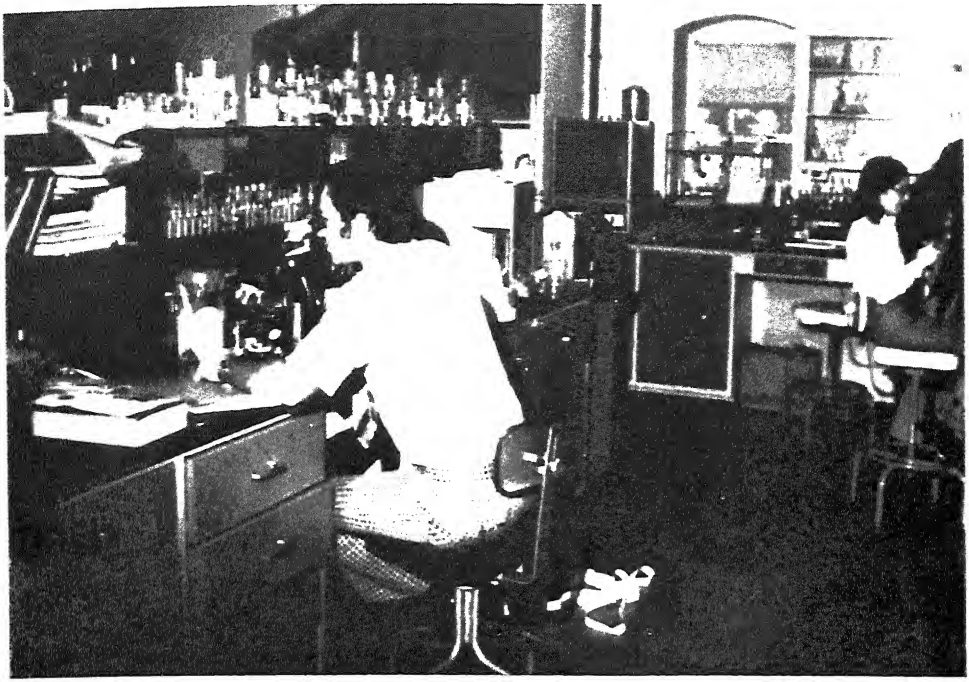
In 1973, the Institute conducted a nationwide study providing a state-of-the-art assessment of the number, training, and experience of criminalists, coroners and medical examiners, forensic anthropologists, forensic odontologists, forensic psychiatrists, forensic toxicologists, questioned document examiners, and evidence technicians. Findings and recommendations are found in three reports:

- *A Survey of Educational Offerings in the Forensic Sciences* (Vol. I)
- *Assessment of the Personnel of the Forensic Sciences Profession* (Vol. II)
- *A Legal Study Concerning the Forensic Sciences Personnel* (Vol. III)

Based on recommendations from the educational assessment, the Law Enforcement Assistance Administration's Office of Criminal Justice Education and Training developed guidelines for programs of higher education in forensic science. The project is described in the final report, *Development of Forensic Science Higher Education Guidelines*.

The educational assessment recommendations resulted, in 1976, in a certification program in forensic science. Certification planning committees were established in toxicology, odontology, physical anthropology, psychiatry, questioned document examination, and criminalistics. As a result of the program:

- All disciplines except criminalistics achieved operational status as certifying bodies;
- 410 forensic scientists were certified as Diplomates in their respective disciplines; and
- a Directory of Diplomates was compiled.



Findings and recommendations from the certification program are presented in a final report, *Forensic Science Certification Program*.

As part of its efforts to explore ways to upgrade forensic sciences, the Institute provided funding in 1977 for a seminar whose purpose was to reduce the communications gap between forensic scientists and forensic information users by expanding user knowledge of forensic capabilities. The seminar, *Suspicious Death Investigation*, was presented before legal and police practitioners outside the forensic science fields, and a final report summarized the program. In addition, a color videotape was produced for interested legal and law enforcement groups—a tape now available for loan at cost from the NCJRS Audiovisual Loan Program.

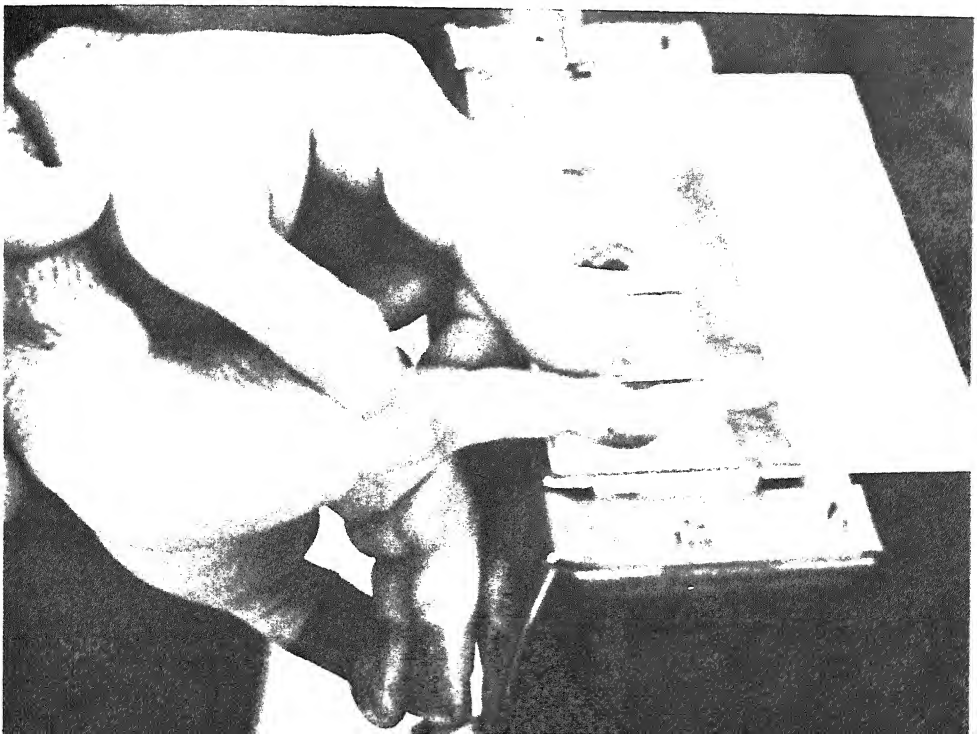
The National Institute also sponsored a Special National Workshop in 1978 for 32 representatives of the legal, scientific, and law enforcement communities. Solutions were explored for forensic utilization problems including communications, organizational characteristics, fairness, personnel, resources, cost-effectiveness, and physical evidence collection. The workshop is described in *Forensic Science Services and the Administration of Justice*.

Utilization and impact

Unless the police gather physical evidence, the forensic scientist has nothing to work with. Unless the evidence is utilized in court (or to clear an innocent suspect), the scientist's work has gone for naught. The research literature is filled with examples of how little of the available physical evidence is collected and examined.

One early study revealed that even though physical evidence may frequently be present at the crime scene, much of it is not preserved and even less is ever analyzed by a forensic laboratory.[1] An Institute study funded in 1977 revealed what experienced investigators have observed:

> *Where the arresting officer manages to recover tangible evidence, the prosecutor is considerably more likely to convict the defendant. When tangible evidence, such as stolen property and weapons, is recovered by the police, the number of convictions per 100 arrests is 60 percent higher in robberies, 25 percent higher in other violent crimes, and 36 percent higher in nonviolent property offenses.*[2]



Another National Institute study, recently completed, analyzes the rate of and reasons for dismissal of criminal cases.[3] Examining samples of cases involving robbery, burglary, and felony assaults from Jacksonville, Fla., and San Diego, Calif., the research reveals that, once cases are formally charged, the most important predictors of convictions are items of evidence. Thus, the earliest decisions made and actions taken concerning a case are the most important in its eventual outcome.

Not only were evidentiary weaknesses, as a whole, the overriding reason for case fallout, but specific types of evidence—alone and in combination—were especially crucial to outcomes. The presence of these types of evidence—eyewitness, confession, possession of property, fingerprints, and victim testimony—could, in fact, help predict case outcomes. The researchers proposed that these "predictability" factors might, through further testing, eventually be applied as criteria by police for determining what kinds of evidence to gather.

The study suggests that improvements in the quality of the police investigation, especially in evidence-gathering skills, and better feedback from the prosecutor, with more two-way police-prosecutor communication, would result in fewer cases being dropped before trial.

Numerous publications have been written about scientific techniques and their application to physical evidence. Although published as long ago as 1973, *Crime Scene Search and Physical Evidence Handbook* remains one of the most popular guides for the police investigator to collecting and preserving evidence.

A project funded by the National Institute in 1980 describes the utilization of physical evidence and its effect on the solution of crimes and the apprehension and conviction of offenders.[4] Some of the findings include:

- Rates of clearance for robberies and burglaries are significantly higher when physical evidence is examined than in cases where it is not.
- Forensic evidence has its greatest effect in cases that traditionally have the lowest solution rates: cases with suspects neither in custody nor identified during the initial investigation.

The draft study includes a number of policy recommendations for police agencies and crime laboratories:

- Patrol units should have more explicit and systematic guidelines as to when they call evidence technicians to the crime scene.
- Technician units should be placed in the same organizational unit as the crime laboratory, and their role expanded.
- Investigators should consider the role of physical evidence when developing guidelines for deciding whether to investigate crimes.
- Crime laboratories must take a more active role in developing policies guiding the investigation of crime scenes and the setting of priorities for the examination of cases in the laboratory.
- Prosecutors should provide feedback to laboratories on the disposition of all cases involving physical evidence.

To make maximum use of forensic science services, the users must thoroughly understand the capabilities of the profession. Even when physical evidence is properly collected and examined, users of the forensic sciences are often uninformed of the capabilities of physical evidence in the courts. One possible reason is that "Scientists do not keep the judges and trial lawyers informed of the current state of the arts in the various disciplines."[5]

"When tangible evidence . . . is recovered by police, the number of convictions . . . is 60 percent higher in robberies, 25 percent higher in other violent crimes . . ."

"Even when physical evidence is properly collected and examined, users of the forensic sciences are often uninformed of the capabilities of physical evidence in the courts."

Two other National Institute studies examine the utilization of forensic evidence. The first, *Utilization of Forensic Evidence in Courts*, is exploring the extent to which various types of physical evidence are used by prosecutors, defense counsel, and the courts themselves, and impact of the evidence when it is used.

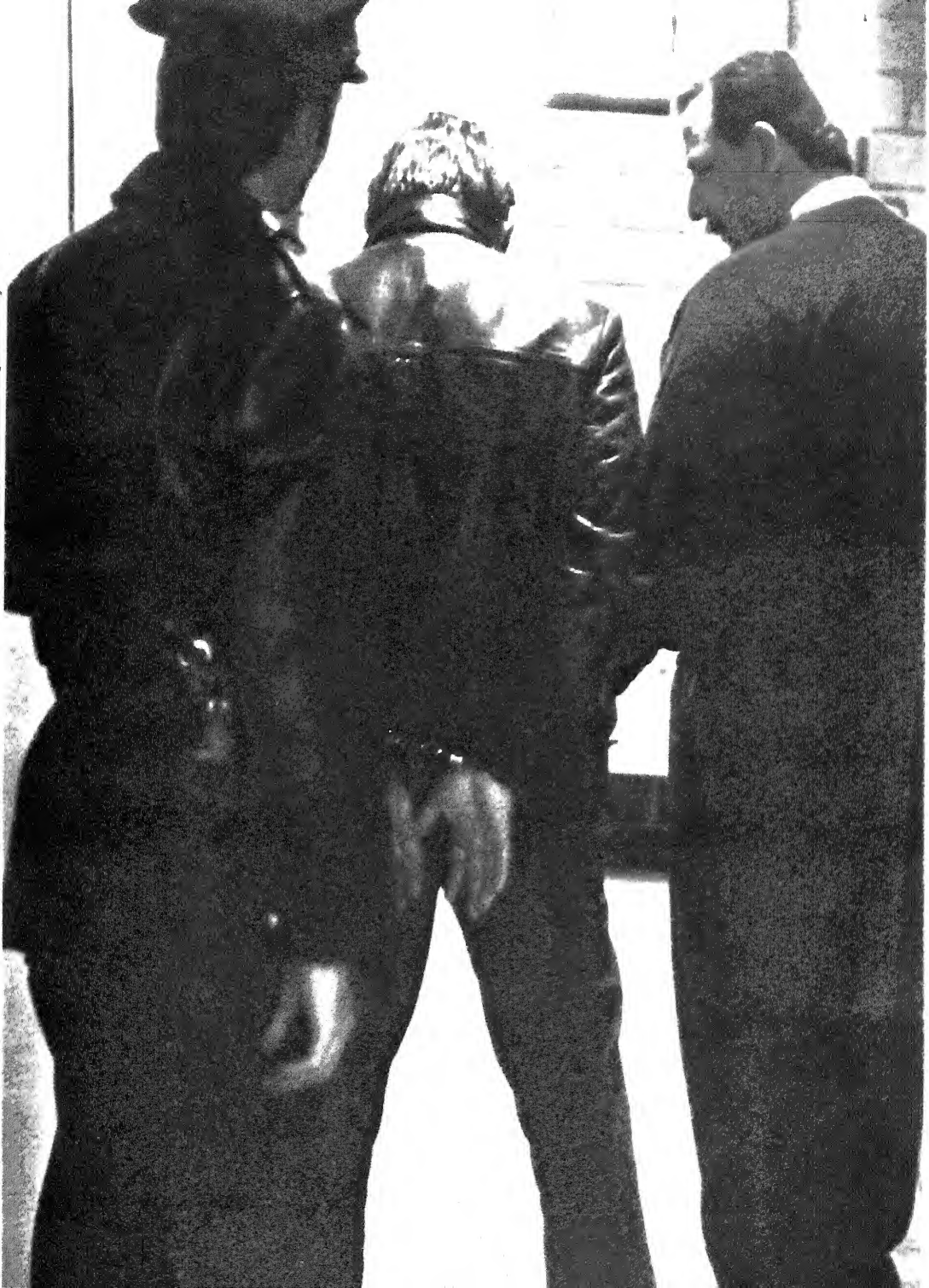
The second study, *Use of Scientific Evidence in Litigation*, was completed in 1982.[6] It identifies problems associated with the use of technological evidence in case dispositions, problems including:

- Difficulty of finding expert witnesses.
- Inadequate preparation of the expert by attorneys.
- Conflicts between the experience of experts as to their role in the proceedings.
- Problems of comprehension in presenting highly technical material to persons who are not technically trained.

Among the solutions the study suggests are frequent substantive exchanges between expert and attorney in preparation for trial.

To maximize use of forensic science skills, the National Institute has funded a project to develop a forensic science manual which, when completed, will include state-of-the-art information written by leading figures in each of the forensic science disciplines.

1. Physical Evidence Utilization in the Administration of Criminal Justice.
2. What Happens After Arrest?
3. Arrests Without Convictions—How Often They Occur and Why, cited in *Justice Assistance News*," 4,4 (May 1983):4.
4. Forensic Evidence and the Police: The Effects of Scientific Evidence on Criminal Investigations (in draft).
5. Forensic Science Services and the Administration of Justice.
6. In addition to the published report, an extensive bibliography is available on loan or in microfiche as NCJ 85621.



APPENDIX A

SELECTED READINGS

Documents are listed below in alphabetical order by title. Except as otherwise noted, all are available from the National Institute of Justice/NCJRS Document Loan Program for up to 4 weeks. Ask your community, academic, or departmental library to send the document title and five-digit "NCJ number" on a standard interlibrary loan form to:

Document Loan Program
National Institute of Justice/NCJRS
Box 6000
Rockville, MD 20850

There is no charge for the interlibrary loan, but a $2.50 per document search charge is levied if your loan request does not include the NCJ number.

Most documents cited in the reading list are available in microfiche, and these are indicated in the citation. Up to 10 microfiche titles can be requested free of charge. If you have a microfiche viewer available, this is a fast, inexpensive way to enlarge your forensic library. Again, give title and NCJ number when ordering microfiche from:

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Washington, DC 20402

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Library Services
National Institute of Justice/NCJRS
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Rockville, MD 20850

Most of the documents listed report on forensic research funded by the National Institute of Justice. Others were selected from the NCJRS data base as source books on forensics. Authors and research organizations are listed beneath the titles.

Assessment of the Forensic Sciences Profession—A Survey of Educational Offerings in the Forensic Sciences, V.1. K.S. Field, M.A. Reich, and B.A. Lipskin. Rockville, Md.: Forensic Sciences Foundation Press. 1975. NCJ 37775. Microfiche.

Assessment of the Personnel of the Forensic Science Profession, V.2. K.S. Field, B.A. Lipskin et al. Rockville, Md.: Forensic Sciences Foundation Press, 1975. GPO stock no. 027-000-00503-9. NCJ 37881. Microfiche.

Assessment of the Forensic Sciences Profession—A Legal Study Concerning the Forensic Sciences Personnel, V 3. O. Schroeder. Colorado Springs, Colo.: Forensic Sciences Foundation, 1977. NCJ 41899. Microfiche.

Bloodstain Analysis System—Final Report. B. Wraxall et al. Anaheim, Calif.: Beckman Instruments, Inc., 1978. NCJ 69249. Microfiche.

Crime Laboratory Proficiency Testing Research Program. E.L. Fabricant, K.S. Field et al. Washington, D.C.: GPO, 1978. Stock no. 027-000-00713-9. NCJ 48122. Microfiche.

Crime Scene Search and Physical Evidence Handbook. R.H. Fox, C.L. Cunningham. Washington, D.C.: GPO, 1973. Stock no. 027-000-00221-8. NCJ 07984.

Death Investigation and Examination. B.A. Lipskin and K.S. Field, ed. Colorado Springs, Colo.: Forensic Sciences Foundation, n.d. NCJ 93232. Microfiche.

Determination of the Age of Bloodstains by Non-Destructive Methods—Final Report. L. May, M.H. Arnold. Washington, D.C.: LEAA, 1971. NCJ 32555. Microfiche.

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Police: Report of the National Advisory Commission on Criminal Justice Standards and Goals. Springfield, Va.: NTIS, 1973. NCJ 10858. Microfiche.

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Time Dependent Electron Paramagnetic Resonance Characteristics of Detonated Primer Residues. Springfield, Va.: NTIS, 1971. NCJ 02826. Microfiche.

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Use of Scientific and Technological Evidence in Litigation—Bibliography, Richard Van Duizend, Michael J. Saks. Williamsburg, Va.: National Center for State Courts, n.d. NCJ 85621. Microfiche.

Utilization of Forensic Sciences in Police Investigations: A Review of the Literature. P.L. Bender, Michael V.K. Gilliland, and Joseph L. Peterson. Center for Research in Law and Justice, University of Illinois at Chicago, 1982. NCJ 88576.

Variant Polypeptides in Hair. H.P. Bladen. NCJ 65254. Microfiche.

What Happens After Arrest?—A Court Perspective of Police Operations in the District of Columbia. S.J. Cox, B. Frost. 1978. NCJ 45633. Microfiche.

APPENDIX B

FORENSIC JOURNALS

The American Journal
of Forensic Medicine and Pathology
20th and Northampton Streets
Easton, PA 18042

Australian Journal of Forensic Sciences
Butterworths Pty. Ltd.
586 Pacific Highway
Chatswood, N.S.W. 2067
Australia

Canadian Society of Forensic Science
Journal
Suite 303
Jelnor Building
171 Nepean Street
Ottawa, Ontario K2P 0B4
Canada

Fire and Arson Investigator
Box 600
Marlboro, MA 01752

Forensic Science Gazette Southwestern
Institute of Forensic Sciences
Box 35728
Dallas, TX 75235

Forensic Science International
250 Fr. Elsevier Sequoia S.A.
Box 851
CH-1001
Lausanne
Switzerland

Forensic Science Society Journal
Box 41
Harrogate, Yorkshire HG1 1BX
England

International Microform Journal of
Legal Medicine and Forensic Sciences
University Microfilms International
300 North Zeeb Road
Ann Arbor, MI 48106

Journal of Forensic Sciences American
Academy of Forensic Sciences
1916 Race Street
Philadelphia, PA 19103

Medicine, Science and the Law
British Academy of Forensic Science
Kluwer Publishing
1 Harlequin Avenue
Brentford, Middx. TW8 9EN
England

Zeitschrift fuer Rechtsmedizin/Journal
of Legal Medicine
Springer-Verlag New York, Inc.
Journal Sales Department
44 Hartz Way
Secaucus, NJ 07904

APPENDIX C

FORENSIC NEWSLETTERS

Arson Analysis Newsletter
Systems Engineering Associates
7349 Worthington-Galena Road
Columbus, OH 43085

Arson Resource Exchange Bulletin
Federal Emergency Management Agency
Washington, DC 20472

The Detective
USA CIDA Headquarters
5611 Columbia Pike
Falls Church, VA 22041

Forensic Serology News
Forensic Sciences Foundation
Suite 201
225 South Academy Boulevard
Colorado Springs, CO 80910.

Identification News
International Association For Identification
Seven Parkway Place
New Hartford, NY 13413

Identification Officer
Louisiana Division
International Association For Identification
660 Dorian Street
New Orleans, LA 70126

The Journal of Polygraph Science
National Training Center of Life Detection, Inc.
57 West 57th Street
New York, NY 10019

Polygraph Law Reporter
American Polygraph Association
Box 1061
Severna Park, MD 21146

Polygraph Review
(same as above)

APPENDIX D

FORENSIC AGENCIES AND ORGANIZATIONS

American Academy of Forensic Sciences
225 South Academy Boulevard
Colorado Springs, CO 80910

American Society of Crime Laboratory Directors
c/o Jerry Chisum
California Dept. of Justice
2213 Blue Gum Avenue
Modesto, CA 95351

Armed Forces Institute of Pathology
Washington, DC 20306

Drug Enforcement Administration
Forensic Science Section
1405 I Street NW.
Washington, DC 20537.

Federal Bureau of Investigation
Training Academy
Forensic Science Research Training Center
Quantico, VA 22135

U.S. Department of the Treasury
Bureau of Alcohol, Tobacco, and Firearms
Forensic Science Laboratory
1401 Research Boulevard
Rockville, MD 20850

FBI Laboratory Division
10th Street and Pennsylvania Avenue NW.
Washington, DC 20535

Center for Human Toxicology
University of Utah
Salt Lake City, UT 84112

American Board of Odontology
c/o Homer R. Campbell, D.D.S.
6800 C Montgomery NE

American Board of Pathology
c/o 112 Lincoln Center
5401 West Kennedy Boulevard
Box 24695
Tampa, FL 33623

American Board of Forensic Psychiatry
c/o Medical and Chirurgical Faculty of Maryland
1211 Cathedral Street
Baltimore, MD 21201

American Society of Forensic Odontology
c/o Dr. James D. Woodward
School of Dentistry
University of Louisville
Louisville, KY 40292

International Association of Coroners and Medical Examiners
2121 Adelbert Road
Cleveland, OH 44106.

National Association of Medical Examiners
1402 S. Grand Boulevard
St. Louis, MO 63104

Milton Helpern Institute of Forensic Medicine
520 First Avenue
New York, NY 10016

International Reference Organization in Forensic Medicine and Sciences
c/o Dr. William G. Eckert Laboratory
St. Francis Hospital
Wichita, KS 67214

American Society of Questioned Document Examiners
1415 Esperson Building
Houston, TX 77002

Forensic Sciences Foundation
Suite 201
225 South Academy Boulevard
Colorado Springs, CO 80910.

International Association for
Identification
Box 139
Utica, NY 13503

World Association of Document
Examiners
111 North Canal Street
Chicago, IL 60606

Independent Association of Questioned
Document Examiners
518 Guaranty Bank Building
Cedar Rapids, IA 52401

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